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Investigation of molecular interfacial reactions between plutonium and manganese oxide hydroxide mineral surfaces

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As part of the Environmental Management Science Program, we are investigating interactions between plutonium and manganese mineral surfaces. Several DOE sites have been contaminated by transuranic radionuclides, and their interactions with surrounding geological media affect their transport and remediation in the environment. Manganese minerals, present as minor phases in the vadose zone, can preferentially sequester plutonium over other minerals present in larger quantities. To determine the parameters governing plutonium sorption, several manganese oxyhydroxides have been characterized, and plutonium ions in different oxidation states have been sorbed onto their surfaces as a function of pH, concentration, and ionic strength. Through the use of x-ray absorption fine structure spectroscopy (XAFS) and spectrophotometry, we have determined that these minerals are reducing the sorbed plutonium. XAFS has also been used to determine structures of sorbed species. Ultimately, this data will be incorporated into models used to predict the migration of plutonium in the environment.